Canadian Foundation for Dietetic Research Letter of Intent

I. Title: Evaluating the effectiveness and implementation of a simple Nutrition Prehabilitation Screening Tool (NPST) before elective colorectal surgery

I. Rationale for importance of project

According to the Canadian Institute for Health Information, more than 1.4 million inpatient surgical procedures are performed in Canada annually[1]. Major surgeries put patients under substantial physical and psychological stress. Yet, standard care does not include patient preparation to combat the stresses of surgery despite median wait time for priority surgeries, including cancer surgeries, ranging from 18-102 days[2]. As examples, assessment and treatment of patient-related surgical risk factors such as malnutrition (20-45%[3]), high blood glucose (30%[4]), and poor exercise tolerance (20-60%[5]) are not routinely practiced. These patient factors contributed 8-fold more to the development of complications after surgery than surgeon and hospital level factors, as shown in a recent prospective cohort of 16,000 colorectal surgeries[6].Additionally, for patients with surgical risk factors, the surgical recovery time is slow: 51% of older adults can expect to experience partial or little functional recovery in the *year* following surgery[7].

Malnutrition is a modifiable surgical risk factor that can be addressed before surgery to improve surgical outcomes. In fact, international surgical care guidelines, including Enhanced Recovery After Surgery, recommend malnutrition screening and a minimum of 7-14 days of nutrition treatment prior to surgery[8]. Moreover, identifying and treating malnutrition is considered a National Standard of Canada (newly recognized by the Standards Council of Canada and created in partnership with the Health Standards Organization and Canadian Malnutrition Task Force). Prehabilitation is a new surgical program that combines preoperative nutrition therapy with anabolic resistance exercise to treat malnutrition before surgery. After just four weeks of multimodal prehabilitation, moderately malnourished colorectal cancer patients improved their functional capacity to a clinically meaningful extent and exhibited significant positive changes in body composition, making them better candidates to withstand the physiological stress of surgery[9]. A surgery-specific screening tool to identify those who would benefit from prehabilitation, however, does not currently exist.

Through retrospective analysis of nutrition-related predictors of adverse surgical outcomes, we have developed a Nutrition Prehabilitation Screening Tool (NPST) comprised of 2 components: 1) reduced food intake or reduced food assimilation (i.e., vomiting or diarrhea) and 2) reduced gait speed of <0.8m/s. Patients identified as being at risk of malnutrition with our tool were 2.4 (95% CI: 1.1 to 5.5) times more likely to have prolonged length of hospital stay and 3.6 (95% CI: 1.6 to 8.4) times more likely to experience a surgical complication. This simple tool predicted adverse surgical outcomes better than the Subjective Global Assessment, which is the reference standard for diagnosing malnutrition but is not surgery-specific (manuscript in progress). These findings suggest that nutritionally deprived patients with compromised function may be of highest priority for targeted interventions before surgery. Given this strong retrospective evidence, we propose a prospective multi-site study of the effectiveness and implementation of NPST.

I. Objective:

We will evaluate the **effectiveness and implementation** of a simple Nutrition Prehabilitation Screening Tool (NPST) across 3 Canadian sites performing colorectal surgery to determine:

1. To what extent is NPST sensitive and specific enough to diagnose malnutrition as compared to the reference standard nutrition assessment tool, the Subjective Global Assessment (SGA)?
2. To what extent is NPST predictive of adverse postoperative surgical outcomes, including complications and hospital readmissions within 30 days of surgery, as compared to available nutrition screening and assessment tools, including the SGA, Global Leadership Initiative on Malnutrition (GLIM), and Canadian Nutrition Screening Tool, (CNST)?
3. To what extent is NPST predictive of adverse patient outcomes at 3-months after surgery, including disability and poor quality of life as compared to the SGA, GLIM and CNST?
4. Finally, how do contextual factors influence implementation success or failure (and how can these contextual factors be modified for success)?

II. Methodology

Study design: Prospective, multi-site observational study

Recruitment: Patients scheduled for elective colorectal surgery across 3 Canadian sites will participate in our data collection. Sites involved in our trial include Montreal General Hospital (Quebec), University Health Network (Ontario), and Peter Lougheed Hospital (Alberta).

Objectives 1-3 (Effectiveness): First, we will establish sensitivity and specificity of NPST in diagnosing malnutrition as compared to reference standard, SGA. Second, we will establish the short- and long-term predictive value (using both clinical and patient outcomes) of NPST in comparison to the SGA, GLIM, and CNST.

At baseline, we will measure:

***Nutritional status*:** The **SGA** is considered the reference standard to diagnose malnutrition[10]. The **CNST** is the Canadian standard for nutrition risk screening[11]. **GLIM** is internationally endorsed to diagnose malnutrition and is becoming a requirement for any malnutrition-related publication[12]. GLIM requires a thorough assessment of body composition and consideration of inflammatory biomarkers. We will use **total lymphocyte/neutrophil ratio**, which can be calculated easily from a routine Complete Blood Count, to identify inflammation. We will use **bioelectrical impedance,** a valid clinical tool to indirectly estimate fat mass and fat-free mass, to *objectively* characterize body composition and diagnose malnutrition using the GLIM criteria.

Physical status: **Hand-grip dynamometer** is a non-invasive, easily administered measure used to determine the maximal isometric strength of the hand and forearms (i.e., grip strength). **10m Gait** is a well-tolerated indicator pf physical performance[13]. The patient is asked to walk at their normal walking speed for 6 meters (2m warm up + 2m cool down) and their speed in meters per second is recorded [14]. **NPST** was developed using 10m gait speed; because, it might not be feasible for future sites to measure gait speed, we will additionally collect and evaluate the **Walking Speed Questionnaire**[15].

30-days after surgery we will collect data on:

***Clinical outcomes*: Complications** will be assessed and graded using the Clavien–Dindo classification (standard in colorectal surgery) and **readmissions** within 30 days of discharge.

3 months after surgery we will collect data on:

Patient-reported outcomes : **Disability** will be measured before and after surgery using the World Health Organizations Disability Assessment Schedule (WHODAS), which is a valid, reliable, and responsive questionnaire for measuring postoperative disability in a diverse surgical population[16]. The **Functional Assessment of Cancer/Chronic Illness Therapy** (**FACT-C)** is a reliable and valid questionnaire that comprehensively assesses functional, emotional, and symptom status of colorectal patients[17].

Objective 4 (Implementation): The Triple C implementation model will be used to implement NPST [18]. Each of the participating sites will engage in *consultation* with interdisciplinary site leaders to prioritize ideas for implementation, *collaboration* to identify those who have the skill to support and sustain screening processes, and *consolidation* through monthly meetings where real-time process data is evaluated to ascertain enablers and barriers of NPST implementation. These team meetings will be recorded and transcribed verbatim. Qualitative data will be analyzed using summative content analysis and deductive coding according to the Theoretical Domains Framework (TDF)[19]. We will use this implementation data to develop a **logic model** to promote adoption of NPST in practice. Logic models specify the inputs (resources), outputs (activities, services) and outcomes needed for successful and sustainable adoption of a new tool or program.

III. Significance to dietetic practice

Our research objective fits well with the Canadian Foundation for Dietetic Research's (CFDR) mandate to fund practice-based research with a nutrition-focused scope. According to CFDR's research directions for 2023, our collaborative research fits with the category of *critically re-thinking dietetics practice*. First, our research findings will impact dietetic practice by evaluating a new nutrition screening tool, the first tool specific to surgery, that will identify patients requiring pre-operative interventions. Second, our implementation phases of consultation, collaboration, and consolidation will engage interdisciplinary stakeholders of administration, surgery, and nutrition departments to establish a logic model that supports NPST adoption. Once we have established a screening pathway, future multi-site and multi-disciplinary studies can be conducted to test which preoperative interventions work best and for whom.

IV. Timeline

The proposed timeline is 22 months: 18 months to recruit patients and enter data, 4 months for statistical analysis and to prepare publication. Our sites perform approximately 350 colorectal surgeries annually. Approximately 30% percent of colorectal surgery patients are moderately malnourished; of those, 10% are severely malnourished, yielding 35 severely malnourished participants per site per year. We will aim to show that NPST has greater than 80% sensitivity to detect patients at risk of malnutrition. Assuming the true sensitivity is at least 95%, then a total of 44 severely malnourished patients is required (90% power, alpha of 0.05)[20]. Given the expected proportion of severely malnourished patients, we will need to recruit 440 evaluable patients in total + 15% drop-out rate, yields ~500 patients in total (17 months). Using a conservative recruitment rate of 30%, we will meet our sample size (among all 3 sites) within the proposed timeframe.

V. Proposed budget: Total $20,000/two years ($10,000/year)

Salary: In-kind data collection and data entry by dietitians (1 hour per patient)	$0
Services: Blood chemistry (in-kind, Complete Blood Count is standard care)	$0
Statistical analysis ($100/hr x 70 hours or ~ 2 weeks)	$7000
Supplies: bioelectrical impedance x1 (2 sites already possess this equipment)	$12000
Conference: Travel and registration fees	$1000

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